PRELIMINARY SIZING OF AN ALTERNATE DEMOLANDER MISSION FOR EXOMARS 2016

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General outline

This student work shall be understood in the context of the new ExoMars 2016 opportunity. The ESA Aurora program aims at developing the capability for Europe to land safely on Mars. In order to do so, the 2016 so-called "methane orbiter" encloses a demonstration of Entry, Descent and Landing on the basis of a 800 kg, 15 day duration probe with a very limited science payload. The purpose of this work is to provide the outline of an alternative design of this EDL mission. In addition, in order to increase the scientific value of the experiment, the probe shall also deploy a technological precursor mission for the 2022 geophysical network opportunity. We therefore propose to work on the following set of high-level requirements:

- DemoLander mass shall be below 150 kg
- Demonstration of a safe Entry, Descent and Landing on Mars & measurements during EDL
- Heat shield instrumentation
- Deployment of a precursor payload for the future geophysical network

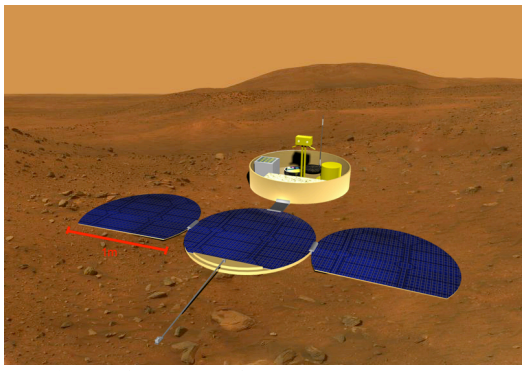

Figure 1 : View of the deployed Lander

Mission Overview

In order to avoid the dust storm season, the proposed baseline mission scenario is a Type-4 6m (ESA). Launching shall be scheduled in September 2015, and the arrival date should be December 2017. The asymptotic speed at Mars approach would be 2.21 km/s. The mission duration is planned to be at least 6 terrestrial months (180 sols) in order to fulfill scientific objectives before the next dust storm season

Mission payload

The Demo Lander should carry four scientific instruments, in a decreasing priority order [3] : a seismometer (SEIS), a context cam, a set of atmospheric probes (AEP) and a magnetometer (MSMO), for a total mass of 7 kg. [2]

Preliminary Probe Sizing

A preliminary sizing has defined the main features of the Lander's components. With respect to the communication architecture, a link budget has been computed. A first power budget (see fig.2) and mass budget have been assessed.

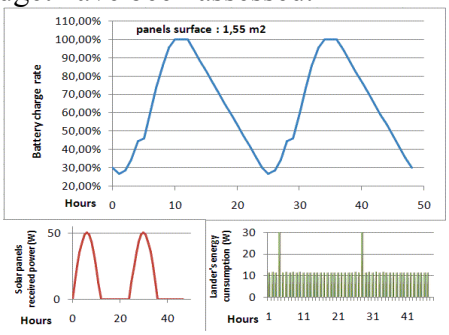

Figure 2 : Battery charge rate as a function of time

Preliminary conclusions of the probe study are the following: solar panel will be used for power source (no RTG), but a RHU is required for the batteries thermal design (like for all successful Mars missions so far). A communication relay link is preferred to a direct to Earth link for payload data (an UHF antenna will be used). The overall probe budget is about 46 kg, including a 20% margin for each subsystem and a 20% system reserve. The EDL shall use a 3 stage parachute system and preliminary estimates are within the remaining 100kg for the overall EDLS.

References

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